US006666663B2

(12) United States Patent
Lee et al.

(10) Patent No.: US 6,666,663 B2
(45) Date of Patent: Dec. 23, 2003

(54) GAS SUCTION APPARATUS FOR A RECIPROCATING COMPRESSOR WITH A PISTON INERTIA VALVE

(75) Inventors: **Hyeong Kook Lee**, Gunpo (KR); **Hyung Jin Kim**, Seoul (KR); **Won Sik Oh**, Seoul (KR); **Hyuk Lee**, Siheung (KR)

(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/038,903**

(22) Filed: **Jan. 8, 2002**

(65) **Prior Publication Data**

US 2003/0072657 A1 Apr. 17, 2003

(30) **Foreign Application Priority Data**

Oct. 15, 2001 (KR) 2001-63422

(51) **Int. Cl.**[7] **F04B 17/03**
(52) **U.S. Cl.** **417/417**; 417/552; 417/545; 417/555.1; 91/422; 137/533.31
(58) **Field of Search** 417/417, 552, 417/545, 555.1; 91/422; 137/533.21, 533.31

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,272,228 A * 6/1981 Kutik et al. 417/460
5,073,095 A * 12/1991 Thomas, Sr. 417/417
5,562,430 A * 10/1996 Schuller et al. 417/545
5,993,178 A * 11/1999 Park et al. 417/545
6,358,026 B1 * 3/2002 Palmore 417/545
6,457,957 B1 * 10/2002 Bauer et al. 417/562
6,497,560 B2 * 12/2002 Carlson 417/553

FOREIGN PATENT DOCUMENTS

DE 693 04 002 T2 3/1997

OTHER PUBLICATIONS

Drees, Heinrich: Kühlanlagen, 15., bearb.Aufl.Berlin: Verlag Technik GmbH, 1992, Seite 140. ISBN: 3–341–00935–3.

* cited by examiner

Primary Examiner—Cheryl J. Tyler
Assistant Examiner—Emmanuel Sayoc
(74) *Attorney, Agent, or Firm*—Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

A gas suction apparatus for a reciprocating compressor, including a piston having a gas flowing passage where refrigerant gas flows, being inserted in the compression space formed in a cylinder enabling linear reciprocating movement, a fixing means combined to the piston and an inertia valve inserted in the gas flowing passage of the piston movably having a moving distance restricted by the fixing means, for opening and closing the gas flowing passage moving according to the pressure difference and inertia generated by the linear reciprocating movement of the piston can minimize dead volume of a gas compression space, ease controlling of a stroke and make the suction flowing of gas smoothly by an excellent reliability of response of valve, thus to improve compression performance. The damage of the component can be also prevented by increasing structural strength, thus to improve reliability.

10 Claims, 6 Drawing Sheets

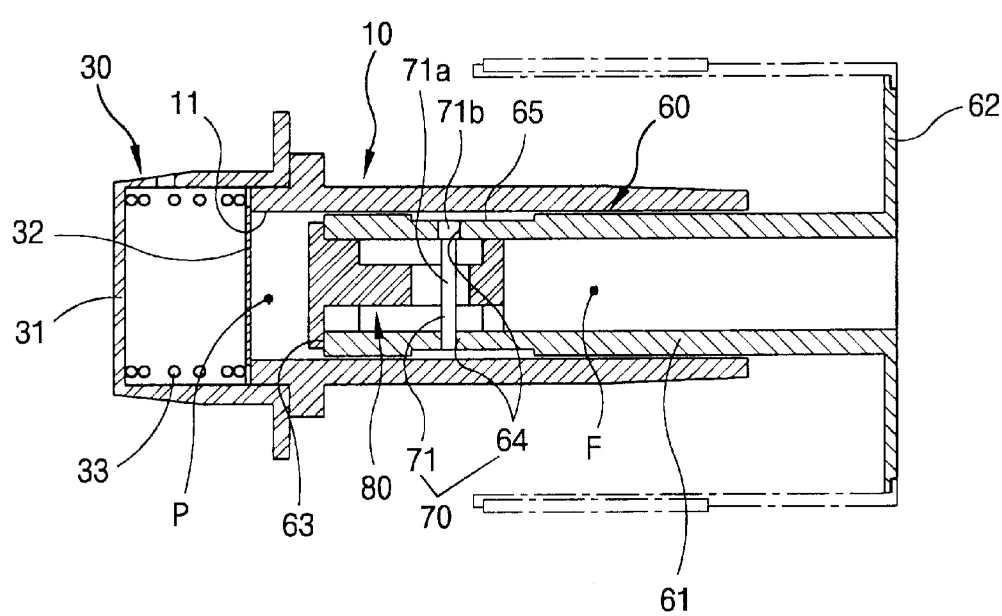


FIG.1
CONVENTIONAL ART

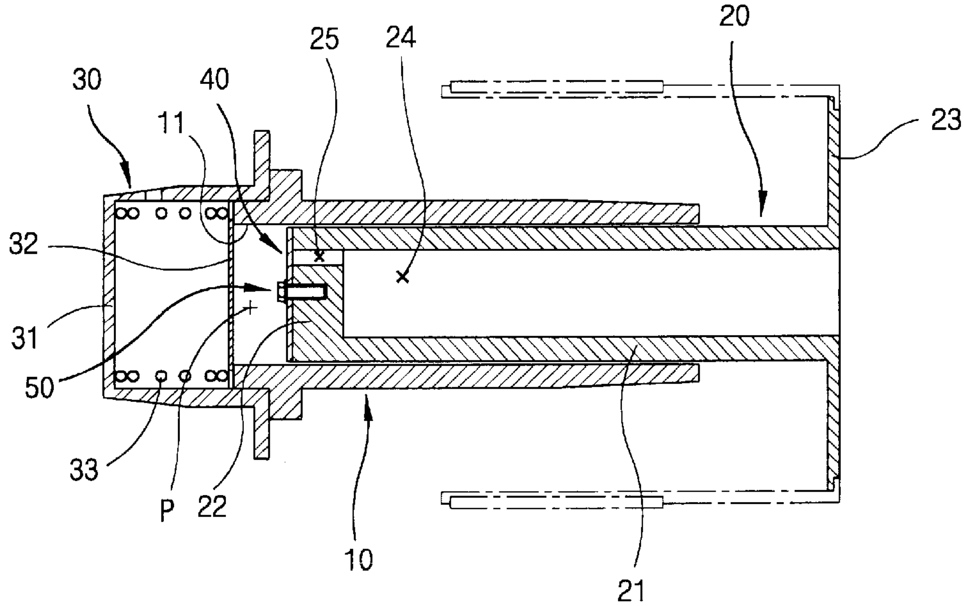


FIG.2
CONVENTIONAL ART

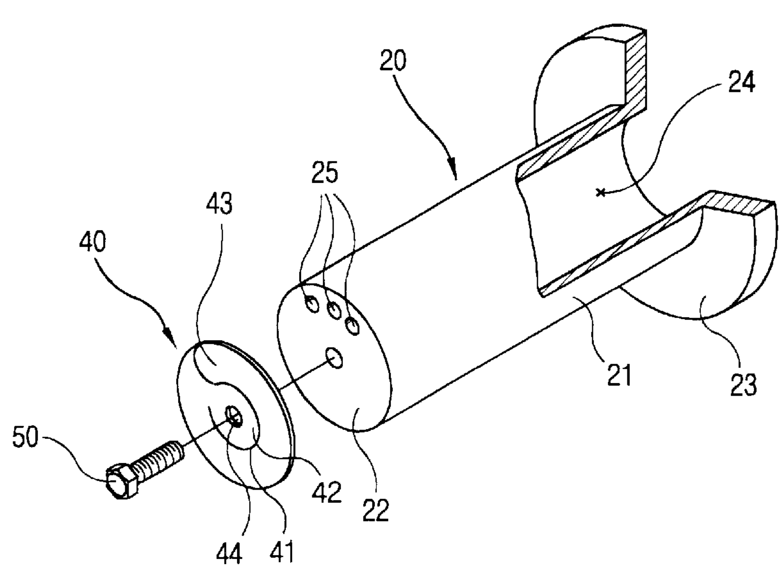


FIG.3
CONVENTIONAL ART

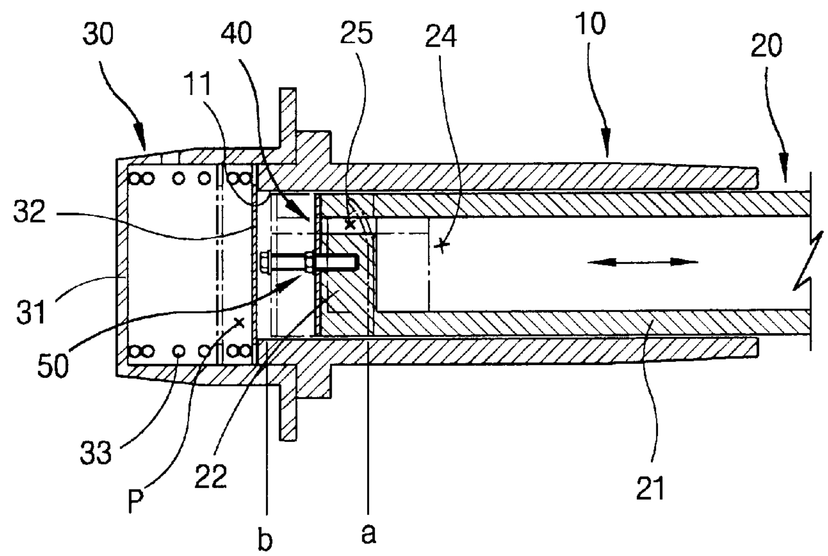


FIG.4
CONVENTIONAL ART

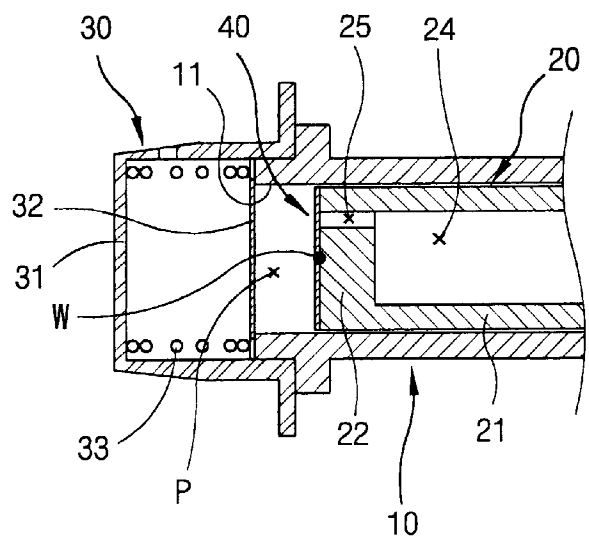
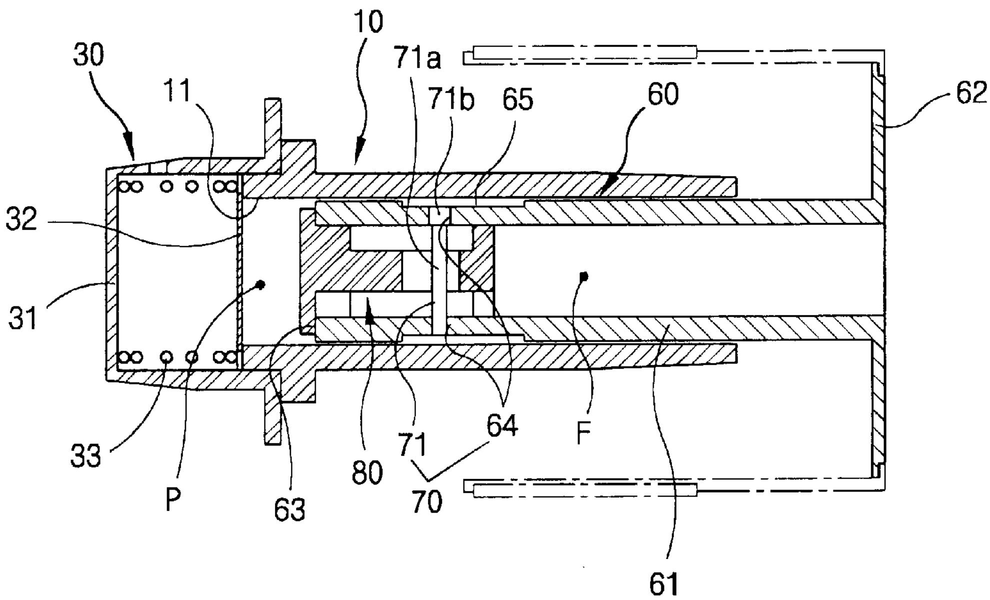
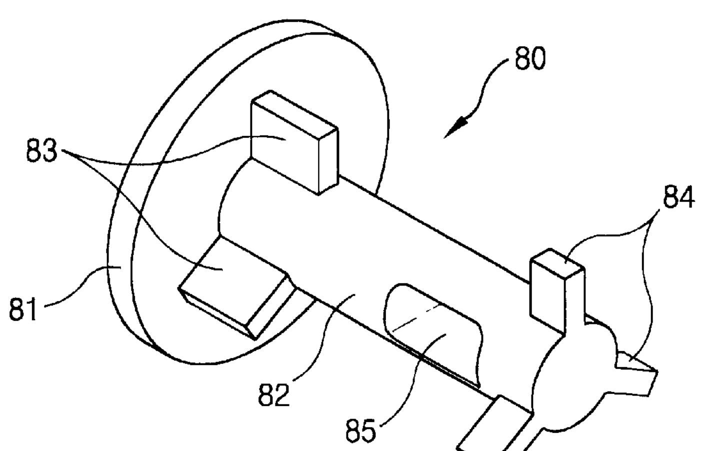


FIG.5



10
30
11
71a
71b
65
60
62
32
31
F
33
P
63
80
71
64
70
61

FIG.6



80
83
84
81
82
85

FIG.7

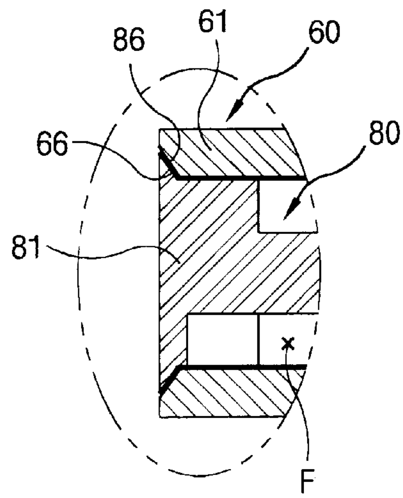


FIG.8

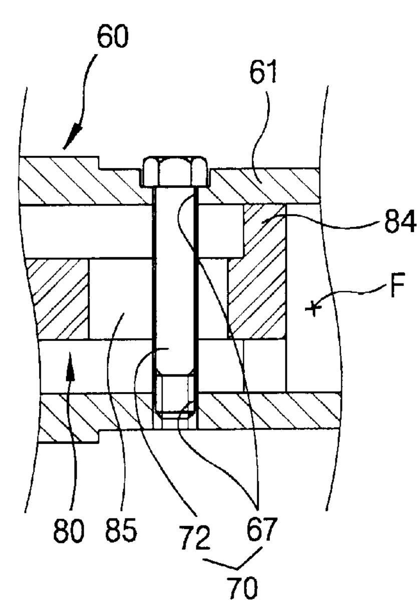


FIG.9

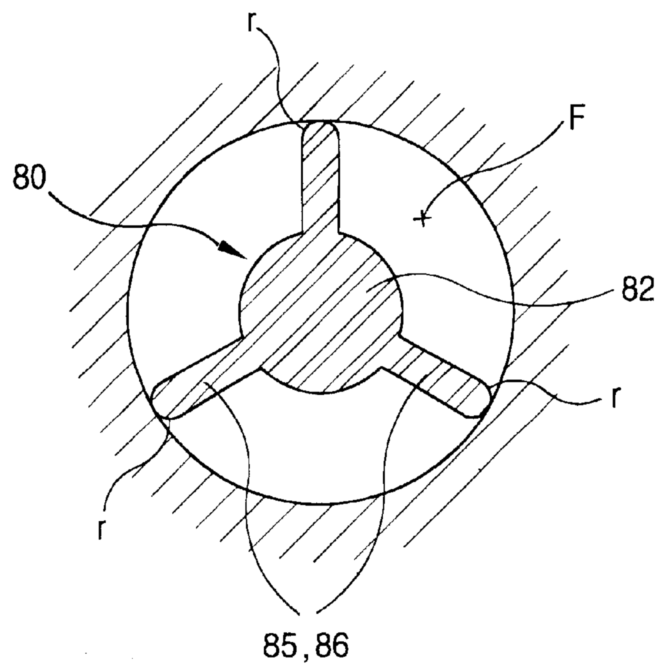


FIG.10

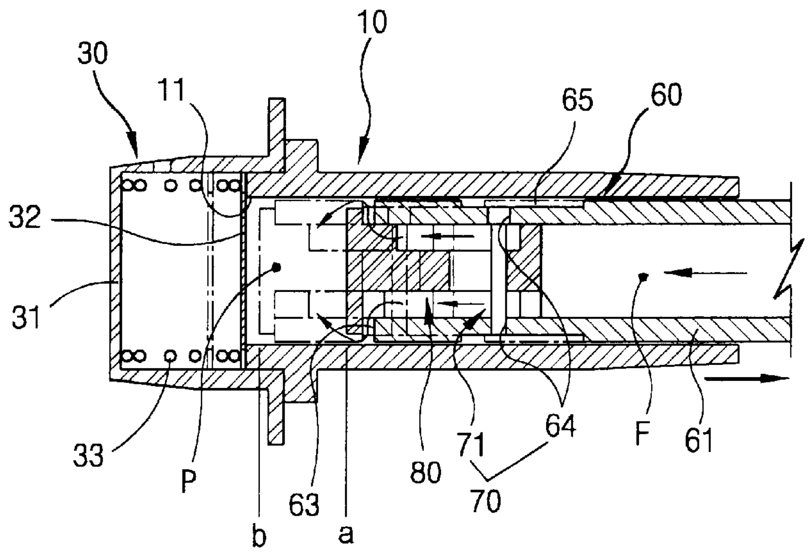
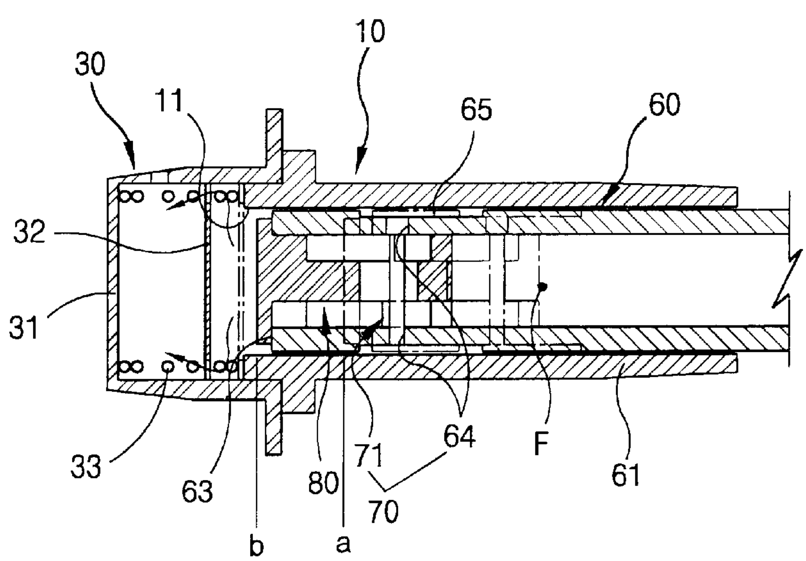

10
30
11
65
60
32
31
33
P
63
b
a
80
71
64
70
F
61

FIG.11


10
30
11
65
60
32
31
33
63
b
80
a
71
64
70
F
61

GAS SUCTION APPARATUS FOR A RECIPROCATING COMPRESSOR WITH A PISTON INERTIA VALVE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a compressing apparatus of refrigerant gas for a reciprocating compressor and particularly, to a gas suction apparatus for a reciprocating compressor capable of improving compressing performance of refrigerant gas and reliability of components.

2. Description of the Background Art

Generally, a compressor is an instrument for compressing fluid such as air and refrigerant gas. The compressor generally includes a driving unit installed in a closed container, for generating a driving force and a compressing unit for sucking and compressing refrigerant gas by receiving the driving force of the above driving unit and is classified into a rotary compressor, reciprocating compressor and a scroll compressor according to the structure of the compressing unit.

The reciprocating compressor among them is a compressor in which a driving force of the driving unit is transmitted to the piston and the piston sucks and compresses refrigerant gas performing linear reciprocating movement in a cylinder.

FIGS. **1** and **2** show an embodiment of the compressing unit of the reciprocating compressor and the compressing unit of the reciprocating compressor includes a cylinder **10** where a through hole **11** forming a compression space P inside the hole is formed, a piston inserted in the through hole **11** of the cylinder **10** enabling linear reciprocating movement and a discharge valve assembly **30** combined to the end portion of the cylinder **10** to cover the through hole **11**.

The piston **20** has a head portion **22** at one side of the body portion **21** having a certain length and a connection portion **23** extended into a certain area at the other side of the body portion **21**. In the body portion **21**, a first gas passage **24** having a certain depth is formed in the body portion **21** and in the head portion, a second gas passage **25** is formed.

The first gas passage **24** is composed of a hole and the second gas passage **25** is composed of a plurality of through holes.

A suction valve **40** for opening and closing the second gas passage **25** is positioned in the head portion **22** and the connection portion **23** of the piston **20** is connected into the driving unit for generating a driving force.

On the other hand, the suction valve **40** is composed of a thin plate in a round form and has a dissection portion **41** is positioned inside the valve. The suction valve is divided into a fixing portion **42** and opening and closing portion **43** by the dissection portion **41**.

The suction valve **40** is fixed-combined to the head portion **22** having a fixing bolt **50** penetrated by the fixing portion **42** under the condition that the valve is contacted on the end surface of the head portion **23** of the piston **20**.

Also, the discharge valve assembly **30** includes a discharge cover **31** combined to cover the end portion of the cylinder **10**, a discharge valve **30** inserted in the discharge cover **31**, for opening and closing the compression space P formed by the through hole **11** and piston **20** of the cylinder **10** and a valve spring **33** for elastically supporting the discharge valve **32**.

In the operation of the compressing unit of the above reciprocating compressor, first, a driving force of the driving unit is transmitted to the piston **20** and the piston **20** performs linear reciprocating movement in the cylinder **10**.

In the process, as shown in FIG. **3**, when the piston **20** moves to the direction of a bottom dead point a, the discharge valve **32** is contacted on the end portion of the cylinder **10** by pressure difference and blocks the compression space P. At the same time, the suction valve **40** combined to the piston **20** is bent and open the second gas passage **25**, thus to suck refrigerant gas to the compression space P formed in the cylinder **10** through the first gas passage **24** and the second gas passage **25** of the piston **20**.

When the piston **20** moves to an upper dead center (b) after reaching the bottom dead center (a), the suction valve **40** is restored to the former condition and the second gas passage **25** of the piston **20** is closed, thus to compress refrigerant gas sucked to the compression space P formed in the cylinder **10**. When the piston **20** reaches the top dead center (b), the discharge valve **32** is opened and the compressed refrigerant gas is discharged.

As the above process is repeated continuously, refrigerant gas is compressed.

However, in the above structure, since the suction valve **40** formed as a thin plate is fixed-combined by the fixing bolt **50**, the head portion of the fixing bolt **50** is positioned in the compression space P in the protruded form and accordingly, a dead volume is generated, thus to decline compressing efficiency. Also, position sensing of the top dead center (b) and bottom dead center (a) of the piston **20** is difficult and accordingly, controlling of a stroke of reciprocating movement of the piston **20** becomes difficult.

Since the suction valve **40** formed as a thin plate is combined by the fixing bolt **50**, design of the second gas passage **25** is limited. Namely, in case the flowing cross section of the second gas passage **25** is large, the flowing cross section where the refrigerant gas flows becomes large. However, the suction valve **40** formed as a thin plate could be damaged by an excessive suction pressure in bending the valve and in case the size of the flowing cross section of the second gas passage **25** is small, the flowing resistance of refrigerant gas could be increased by the small cross section.

As the piston **20** moves, in the process that the suction valve **40** is repeated opened or closed, a slip rotation is generated between the suction valve **40** and the fixing bolt **50** and accordingly, compressing performance could not be performed well since the piston **20** is seceded from the second gas passage **25**.

Also, as the suction valve **40** was bent and restored to its former state, the second gas passage **25** is opened or closed and accordingly, a fatigue crack is generated and a screw hole **44** for combining the fixing bolt **50** is formed at the bending portion of the suction valve **40**. Therefore, structural strength was declined.

As a structure for making up for the above disadvantage, as shown in FIG. **4**, an embodiment that the fixing portion **42** of the suction valve **40** is directly welded-connected to the end surface of the head portion **22** of the piston **20** is disclosed.

With such structure, the dead volume can be reduced and control of a stroke is eased but, characteristic of the material is changed by heat transformation by welding heat for welding the suction valve **40** on the head portion **22** of the piston **20**. When the opening and closing operation of the suction valve **40** is continuously performed, cracks by fatigue are generated centering around the welding point, thus to decrease reliability of the compressor.

SUMMARY OF THE INVENTION

Therefore, the present invention provides a gas suction apparatus for a reciprocating compressor which can make the suction of refrigerant gas smoothly and increase structural combining strength.

Also, another object is to provide a gas suction apparatus for a reciprocating compressor which can minimize dead volume of a compression space of refrigerant gas and ease controlling of a stroke.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a gas suction apparatus for a reciprocating compressor comprising a piston having a gas flowing passage where refrigerant gas flows, being inserted in the compression space formed in a cylinder enabling linear reciprocating movement, a fixing means combined to the piston, an inertia valve including a valve cone portion formed to have a larger area than the cross section of the gas flowing passage and a certain thickness, for opening and closing the gas flowing passage, being contacted on the end surface of the piston or separated, a valve body portion extended having a smaller outer diameter than the inner diameter of the gas flowing passage at the center of the one side surface of the valve cone portion and inserted in the gas flowing passage, a plurality of guide members extended to have a certain length on the outer circumferential surface of the valve body portion and contacted on the inner circumferential surface of the gas flowing passage and an inertia valve penetrated-formed to have a certain width and length in the valve body portion having the fixing means inserted in the valve.

The foregoing and other, features, aspects and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. **1** is a cross-sectional view showing a compressing unit of a conventional reciprocating compressor;

FIG. **2** is a partial perspective view showing an embodiment of a valve combining structure of the conventional reciprocating compressor;

FIG. **3** is a cross-sectional view showing an operational condition of the compressing unit of the conventional reciprocating compressor;

FIG. **4** is a cross-sectional view showing another embodiment of the valve combining structure of the conventional reciprocating compressor;

FIG. **5** is a cross-sectional view showing a compressing unit of a reciprocating compressor having a gas suction apparatus for a reciprocating compressor in accordance with the present invention;

FIG. **6** is a perspective view showing an inertia valve composing the gas suction apparatus for the reciprocating compressor in accordance with the present invention;

FIG. **7** is a cross-sectional view showing an embodiment of another valve cone portion of the inertia valve composing the gas suction apparatus for the reciprocating compressor in accordance with the present invention;

FIG. **8** is a cross-sectional view showing another embodiment of a fixing means composing the gas suction apparatus for the reciprocating compressor in accordance with the present invention;

FIG. **9** is a cross-sectional view showing another modified example of a guide feet composing the gas suction apparatus for the reciprocating compressor in accordance with the present invention;

FIG. **10** is a cross-sectional view showing an operational condition of the compressing unit in a suction operation of the compressor having the gas suction apparatus for a reciprocating compressor in accordance with the present invention; and

FIG. **11** is a cross-sectional view showing an operational condition of the compressing unit in a compressing operation of the compressor having the gas suction apparatus for a reciprocating compressor in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

Reference numeral which are same as the conventional art designates the same reference numeral and the description will be omitted.

FIG. **5** is a cross-sectional view showing a compressing unit of a reciprocating compressor having a gas suction apparatus for a reciprocating compressor in accordance with the present invention. As shown in FIG. **5**, The compressing unit of the reciprocating compressor includes a cylinder **10** where a through hole **11** forming a compression space P inside the hole is formed, a piston having a gas flowing passage where refrigerant gas flows, being inserted in the compression space formed in a cylinder enabling linear reciprocating movement, a discharge valve assembly **30** combined to the end portion of the cylinder **10** to cover the through hole **11**, a fixing means **70** combined to the piston **60** and an inertia valve **80** inserted in the gas flowing passage F movably to have a restricted moving distance by the fixing means **70**, for opening and closing the gas flowing passage F moving according to pressure difference and inertia generated by linear reciprocating movement of the piston **60**.

Here, the piston **60** has a certain length, a gas flowing passage F penetrated having a certain inner diameter is formed at the center of the body portion **61** formed in an annual bar form and a connection portion **62** extended along the circumferential direction having a certain area is formed at one side of the body portion **61**.

The end surface of the piston body portion **61** positioned at the opposite side of the connection portion **62** is formed as a flat surface forming a sealing surface **63** and the connection portion **62** is connected to the driving unit for generating a driving force.

The fixing means **70** includes a pin combining hole **64** penetrated-formed at one side of the piston **60** to cross the gas flowing passage F of the piston **60** and a fixing pin **71** inserted-fixed to the pin combining hole **64**, for restricting the moving distance of the inertia valve **80**.

The fixing pin **71** includes a pin portion **71***a* having a certain outer diameter and length and a head portion **71***b* formed to have a certain length and an outer diameter larger than that of the pin portion **71***a* at one side of the pin portion **71***a*.

It is desirable that the pin combining hole **64** formed in the body portion **61** of the piston **60** is formed to have a different inner diameter so that the fixing pin **71** can be inserted and a stepped portion **65** is formed on the outer circumferential surface of the piston body portion **61** where the pin combining hole **64** is formed not to be contacted on the inner circumferential surface of the cylinder **10** when it is operated.

Also, as shown in FIG. **6**, the inertial vale **80** includes a valve cone portion **81** having a larger area than the cross section of the gas flowing passage F and a certain thickness, for opening and closing the gas flowing passage F, being contacted on the end surface of the piston **60** or separated, a valve body portion **82** extended having a smaller outer diameter than the inner diameter of the gas flowing passage F at the center of the one side surface of the valve cone portion **81** and inserted in the gas flowing passage F, a plurality of guide feet **83** and **84** extended to have a certain length on the outer circumferential surface of the valve body portion **82** and contacted on the inner circumferential surface of the gas flowing passage F and a guide hole **85** penetrated-formed having a certain width and length, in which the fixing means **70** are inserted.

The guide feet **83** and **84** include a plurality of front guide feet **83** formed on an outer circumferential surface at a side of the valve body portion **82** at a certain interval to be positioned at the side of the valve cone portion **81** and a plurality of rear guide feet **84** formed at the other side of the guide hole **85** having a certain distance from the front guide feet **83**.

It is desirable that the front guide feet **83** are formed contacted on the portion ranged from the outer circumferential surface of the valve body portion **82** to the inner side surface of the valve cone portion **81** to increase the structural strength.

The front guide feet **83** are radially formed at a certain interval in the circumferential direction of the valve body portion **82** and the rear guide feet **84** are radially formed at a certain interval in the circumferential direction of the valve body portion **82**.

It is desirable that the numbers of the front guide feet **83** and the rear guide feet **84** are formed same and the direction is formed to be positioned on a same line in the shaft direction of the valve body portion **82**.

Also, the end surface of the guide feet **83** and **84** contacted with the inner circumferential surface of the piston **60** is formed in a square surface.

The guide member can further include a plurality of middle guide feet **830**, **850** radially formed on the circumferential surface of the piston **60** between the front guide feet **83** and the rear guide feet **84** along the same circumferential direction.

The middle guide feet **830**, **850** can be respectively positioned on the same line along the shaft direction of the valve body portion **82** where the front guide feet **83** and the rear guide feet **84** are formed, as shown in FIG. **8**, or the middle guide feet **830**, **850** can be formed on a dislocated line from the shaft direction for better guidance, as shown in FIG. **9**.

On the other hand, in the inertia valve **80**, the inner surface of the valve cone portion **81** is contacted-combined on the sealing surface **63** of the piston **60** as the lengthy portion **82** and guide feet **83** and **84** are inserted to the gas flowing passage F of the piston **60**.

At this time, the guide feet **83** and **84** are contacted-supported on the inner circumferential surface of the gas flowing passage F.

Under the condition that the guide hole **85** of the inertia valve **80** and the pin combining hole **64** formed at the piston **60** are unified, the fixing pin **71** Composing the fixing means **70** is penetrated inserted and fixed-combined to the pin combining hole **64** of the piston **60** and the guide hole **85** of the inertia valve **80**.

Since a fixing pin **71** is inserted in the guide hole **85** in the inertia valve **80**, moving distance is limited by the fixing pin **71**.

On the other hand, as shown in FIG. **7**, in the other embodiment of the sealing structure between the valve cone portion **81** of the inertia valve **80** and the end surface of the piston body portion **61**, a chamfered inclination contact surface **66** is formed on the border of the gas flowing passage F positioned on the end surface of the piston **60** and an inclination contact surface **86** which is formed to be contacted on the above inclination contact surface **66** is formed on the inner border of the valve cone portion **81** of the inertia valve **80**.

Also, as shown in FIG. **8**, the other embodiment of the fixing means **70** includes a bolt combining hole **67** penetrated-formed at one side of the piston **60** to cross the gas flowing passage F of the piston **60** and a fixing bolt **72** combined to the bolt combining hole **67**, for restricting the moving distance of the inertia valve **80**.

On the other hand, as shown in FIG. **9**, the guide feet **83** and **84** are formed in the same position and shape as above but the feet can be formed as transformed guide feet **85** and **86** having the end surface meeting with the inner circumferential surface of the piston **60** forming a curved surface r, thus to move more smoothly.

Also, the guide feet are formed at both sides of the valve body portion **82** but the guide feet can be formed having more guide feet at the center portion of the lengthy portion **82** to perform more smooth and reliable movement.

The discharge valve assembly **30** includes a discharge cover **31** combined to cover the through hole **11** of the cylinder **10**, a discharge valve **32** inserted in the discharge cover **31** and formed by the through hole **11** and the piston **60** of the cylinder **10**, for opening and closing the compression space P and a valve spring **33** for supporting the discharge valve **32** elastically.

Hereinafter, the operation and effect of the gas suction apparatus for the reciprocating compressor in accordance with the present invention will be described.

Firstly, the operation of the compressing unit of the reciprocating compressor is performed as follows. When driving force of the driving unit is transmitted to the piston **60** and the piston **60** performs linear reciprocating movement inside the cylinder **10**, namely, between the top dead center (b) and the bottom dead center (a) of the compression space P, the inertia valve **80** performs linear reciprocating movement by pressure difference of the compression space P of the cylinder **10** and inertial of the inertia valve **80** and opens and closes the gas flowing passage F of the piston **60**. Accordingly, refrigerant gas is sucked to the compression space P of the cylinder **10** through the gas flowing passage F of the piston **60** and the gas is compressed and discharged by the opening and closing performance of the discharge valve **32** which composes a discharge valve assembly **30**.

In the process, first, when the piston **60** moves to the bottom dead center (a), as shown in FIG. **10**, under the condition that the inner surface of the valve cone portion **81** of the inertia valve **80** and the sealing surface **63** of the piston **60** is opened by pressure difference of the inner and outer portion of the compression space P and stop inertia of the inertia valve **80**, the inertia valve **80** is caught by the fixing pin **71** which is the fixing means **70** and moves to the bottom dead center (a) together with the piston **60** and at the same time, the refrigerant gas flows through the gas flowing passage F of the piston **60**. Then the refrigerant gas passes through the space between the outer circumferential surface of the valve body portion **82** of the inertia valve **80** and the inner wall of the gas flowing passage F and is sucked to the compression space of the cylinder **20** through the portion between the inner surface of the valve cone portion **81** of the inertia valve **80** and the sealing surface **63** of the piston **60**.

As shown in FIG. **11**, when the piston **60** moves from the bottom dead center (a) to the top dead center (b), by inertia of the inertia valve **80**, pressure difference and movement of the piston **60**, the fixing pin **71** which is a fixing means **70** moves along the guide hole **85** of the inertia valve **80** and supports the inner wall of the guide hole **85**. The inner surface of the valve cone portion **81** of the inertia valve **80** is contacted on the sealing surface **63** of the piston **60** and the gas flowing passage F of the piston **60** is blocked. Accordingly, refrigerant gas sucked to the compression space P of the cylinder **10** is compressed as the piston moves to the top dead center (b).

Then, when the piston **60** reaches the top dead center (b), the discharge valve **32** is opened and the refrigerant gas sucked to the compression space P of the cylinder **10** is discharged.

As the above process is repeated, the refrigerant gas is sucked, compressed and discharged.

On the other hand, as the piston **60** performs linear reciprocating movement, in the process that the inertia valve **80** performs linear reciprocating movement in the gas flowing passage F of the piston **60**, since the guide feet **83**, **84**, **85** and **86** of the inertia valve **80** are contacted-supported on the inner circumferential surface of the gas flowing passage F, the inertia valve **80** can move uniformly without slanting to a side and rotary movement of the inertia valve **80** is restricted by the fixing means **70**.

Also, since the surface of the valve cone portion **81** of the inertia valve **80** positioned at the compression space P of the cylinder **10** is formed in a flat form in the apparatus in accordance with the present invention, dead volume of the compression P is minimized and position sensing of the stroke of the piston **60** becomes easier, thus to ease stroke controlling of the piston **60**. Namely, in the present invention, since the dead volume generated by the head portion of the fixing bolt **50** is excluded in combining the fixing bolt **50** as conventionally, the compression space P is relatively larger and position sensing of the stroke of the piston **60** is easy.

Also, with the present invention, since the inertia valve **80** has a certain volume and weight, the structural strength is increased and the design of the cross section of the gas passage **25** where refrigerant gas flows is not limited. Namely, conventionally, the cross section of the gas passage **25** where refrigerant gas flows is designed according to strength of the suction valve **40** using the suction valve **40** formed as a thin plate and accordingly, design for increasing the cross section of the inertia valve **80** is limited. However, in accordance with the present invention, by applying the gas passage **25** limit in designing the gas passage according to strength of the suction valve **40** is removed.

Also, in accordance with present invention, since an opening amount of the inertia valve **80** is limited by the fixing means **70**, reliability of response of the inertia valve **80** becomes excellent and the refrigerant gas can be sucked and flown smoothly.

As described above, the gas suction apparatus for the reciprocating compressor can minimize the dead volume of the compression space and control the stroke easily. Refrigerant gas is smoothly sucked and flown by excellent reliability of response of the valve and compressing performance can be improved. Also, damage of the components is restricted by increasing the structural strength, thus to improve reliability of the compressor.

As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. A gas suction apparatus for a reciprocating compressor, comprising:

a piston having a gas flowing passage where refrigerant gas flows, being inserted in the compression space formed in a cylinder enabling linear reciprocating movement;

an inertia valve; and

fixing means combined to the piston for restricting reciprocating motion of the inertia valve,

the inertia valve including:

a valve cone portion formed to have a larger area than the cross section of the gas flowing passage and a certain thickness, for opening and closing the gas flowing passage, being contacted on the end surface of the piston or separated;

a valve body portion extended having a smaller outer diameter than the inner diameter of the gas flowing passage at the center of the one side surface of the valve cone portion and inserted in the gas flowing passage;

a plurality of guide members extended to have a certain length on the outer circumferential surface of the valve body portion and contacted on the inner circumferential surface of the gas flowing passage; and

a guide hole formed to have a certain width and length in the valve body portion having the fixing means inserted in the inertia valve.

2. The apparatus of claim **1**, wherein the piston comprises:

a body portion formed in an annual bar shape having a certain length and having a gas flowing passage penetrating a certain inner diameter at the center;

a connection portion extended along the circumferential direction having a certain area at a side of the body portion; and

a pin hole formed at a side portion of the body portion to be combined with the fixing means.

3. The apparatus of claim **1**, wherein the guide member comprises:

a plurality of front guide feet formed on an outer circumferential surface of the valve body portion to be positioned at the valve cone portion side; and

a plurality of rear guide feet formed on the outer circumferential surface of the valve body portion positioned at the guide hole side having a certain interval from the front guide feet.

4. The apparatus of claim **3**, wherein the front guide feet are formed to contact the outer circumferential surface of the valve body portion and the inner side surface of the valve cone portion simultaneously.

5. The apparatus of claim **3**, wherein the guide member further comprises:

a plurality of middle guide feet radially formed on the piston between the front guide feet and the rear guide feet.

6. The apparatus of claim **5**, wherein the middle guide feet are respectively positioned on lines extending parallel to the valve body portion between the front guide feet and the rear guide feet.

7. The apparatus of claim **5**, wherein the middle guide feet are respectively positioned at locations dislocated from lines extending parallel to the valve body portion from the front guide feet to the rear guide feet.

8. The apparatus of claim **1**, wherein the sectional shape of the outer end surface of the guide members is correspondent to a curvature radius of the inner circumferential surface of the gas flowing passage formed in the piston.

9. The apparatus of claim **1**, wherein the fixing means comprises:

a pin hole formed at one side of the piston to cross the gas flowing passage of the piston; and

a fixing pin inserted in the inertia valve and fixed in the pin hole, for restraining moving distance of the inertia valve.

10. The apparatus of claim **1**, wherein the fixing means comprises:

a bolt hole formed at one side of the piston to cross the gas flowing passage of the piston; and

a fixing bolt inserted in the inertia valve and combined to the bolt hole, for restraining moving distance of the inertia valve.

* * * * *